REMARKS

In view of the following discussion, the Applicants submit that none of the claims now pending in the application is anticipated under the provisions of 35 U.S.C. §102 or made obvious under the provisions of 35 U.S.C. §103. Thus, the Applicants believe that all of these claims are now in allowable form.

I. REJECTION OF CLAIMS 1, 3-6, 8-10 AND 12-36 UNDER 35 U.S.C. §102

The Examiner rejected claims 1, 3-6, 8-10 and 12-36 under 35 U.S.C. §102(e) as being anticipated by the Sharma et al. application (U.S. Patent Application Publication No. 2002/0143551, published October 3, 2002, hereinafter "Sharma"). The Applicants respectfully traverse the rejection.

Particularly, the Applicants respectfully direct the Examiner's attention to the fact that Sharma fails to disclose or suggest the novel invention of generating a grammar and one or more related subgrammars (including, for example, a word subgrammar, a phone subgrammar and a state subgrammar) based at least in part on a grammar provided by a remote computer, as claimed in Applicants' independent claims 1, 11, 18, 34, 35 and 36.

By contrast, Sharma at most teaches performing recognition processing of a speech signal at a remote computer. Sharma does not disclose, teach or suggest receiving a grammar from a remote computer for use in generating a grammar and related subgrammars.

Specifically, Sharma teaches a distributed architecture for spoken dialogue systems, wherein a location (*e.g.*, a client device, a server and/or a gateway) at which recognition processing of a speech signal occurs is selected based on the application using the speech signal. If the application requires only a small vocabulary for speech recognition (*e.g.*, "command and control applications", Sharma, paragraph [0031]), recognition may be performed at the client device that captures the speech signal. If a larger vocabulary is required (*e.g.*, "natural language processing", Sharma, paragraph [0033]), the speech signal may be sent to the server for recognition. Thus, unlike the Applicants' claimed invention, in which recognition processing is performed locally using

a grammar provided by a remote computer, Sharma teaches that the remote computer (*i.e.*, server) provides the actual recognition processing.

Sharma thus fails to disclose or suggest the novel invention of generating a grammar and one or more related subgrammars based at least in part on a grammar provided by a remote computer, as claimed in Applicants' independent claims 1, 11, 18, 34, 35 and 36. Specifically, Applicants' claims 1, 11, 18, 34, 35 and 36 positively recite:

1. A method for allocating memory in a speech recognition system comprising the steps of:

acquiring a first set of data structures that contain a grammar, a word subgrammar, a phone subgrammar and a state subgrammar, each of the subgrammars related to the grammar, wherein the first set of data structures is generated by the speech recognition system based at least in part on a grammar provided by a remote computer;

acquiring a speech signal;

performing a probabilistic search using the speech signal as an input, and using the first set of data structures as possible inputs; and

allocating memory for one of the subgrammars when a transition to that subgrammar is made during the probabilistic search. (Emphasis added)

11. In a speech recognition system, a method for recognizing speech comprising the steps of:

acquiring a first set of data structures that contain a grammar, a word subgrammar, a phone subgrammar and a state subgrammar, each of the subgrammars related to the grammar, wherein the first set of data structures is generated by the speech recognition system based at least in part on a grammar provided by a remote computer;

acquiring a speech signal;

performing a probabilistic search using the speech signal as an input, and using the first set of data structures as possible inputs;

allocating memory for one of the subgrammars when a transition to that subgrammar is made during the probabilistic search; and

computing a probability of a match between the speech signal and an element of the subgrammar for which memory has been allocated. (Emphasis added)

18. In a speech recognition system, a method for recognizing speech comprising the steps of:

acquiring a first set of data structures that contain a top level grammar and a plurality subgrammars, each of the subgrammars hierarchically related to the grammar

and to each other, wherein the first set of data structures is generated by the speech recognition system based at least in part on a grammar provided by a remote computer;

acquiring a speech signal;

performing a probabilistic search using the speech signal as an input, and using the first set of data structures as possible inputs;

allocating memory for specific subgrammars when transitions to those specific subgrammars are made during the probabilistic search; and

computing probabilities of matches between the speech signal and elements of the subgrammars for which memory has been allocated. (Emphasis added)

34. A method for allocating memory in a speech recognition system comprising the steps of:

acquiring a set of data structures that contain a grammar and one or more subgrammars related to the grammar, wherein the first set of data structures is generated by the speech recognition system based at least in part on a grammar provided by a remote computer;

acquiring a speech signal;

performing a probabilistic search using the speech signal as an input, and using the set of data structures as possible inputs; and

allocating memory for a selected one or more of the subgrammars when a transition to the selected subgrammar is made during the probabilistic search. (Emphasis added)

35. In a speech recognition system, a method for recognizing speech comprising the steps of:

(a) acquiring a set of data structures that contain a grammar and one or more subgrammars related to the grammar, wherein the first set of data structures is generated by the speech recognition system based at least in part on a grammar provided by a remote computer;

(b) receiving spoken input;

(c) using one or more of the data structures to recognize the spoken input;

(d) while the speech recognition system is operating, acquiring a second set of data structures that contain a second grammar and one or more subgrammars related to the second grammar; and

(e) repeating steps (b) and (c), using the second set of data structures in step (c). (Emphasis added)

36. In a speech recognition system, a method for recognizing speech comprising the steps of:

(a) acquiring from a first remote computer a set of data structures that contain a grammar and one or more subgrammars related to the grammar;

(b) receiving spoken input;
(c) using one or more of the data structures to recognize the spoken input;
(d) while the speech recognition system is operating, acquiring a second set of data structures from the first remote computer or from a second remote computer, the second set of data structures containing a second grammar and one or more subgrammars related to the second grammar; and
(e) repeating steps (b) and (c), using the second set of data structures in step (c). (Emphasis added)

Applicants' invention is directed to a method for allocating memory in a speech recognition system. Conventional speech recognition systems require a great deal of memory in order to accommodate and process large vocabularies. These systems typically compile, expand, flatten and optimize all grammars contained in a system vocabulary into a large, single-level data structure that must be stored in memory before the speech recognition system can operate. Such techniques substantially restrict the capabilities of speech recognition systems that operate on limited memory and processing power, such as portable speech recognition systems.

The present invention provides a method for speech recognition in which memory is allocated to a particular system subgrammar when a transition is made to that subgrammar during a probabilistic search. A system vocabulary has a hierarchical data structure including at least one top-level grammar (*e.g.*, "Days of the Week") and at least one subgrammar within that top-level grammar such as a word subgrammar (*e.g.*, Monday, Tuesday, Wednesday, etc.), a phone subgrammar (*e.g.*, /m/, /ah/, /n/, /d/, /ey/, etc.) and a state subgrammar (*e.g.*, comprising Hidden Markov Models). When the system receives a speech signal for processing, the speech signal is input, along with the (unexpanded) top-level grammar and one or more subgrammars, into a probabilistic search. When a transition is made to a particular subgrammar during the probabilistic search, memory is allocated to the subgrammar, which may then be expanded and evaluated to assess the probability of a match between the speech signal and an element in the subgrammar. In this manner, memory is conserved and allocated only to portions of the system vocabulary that are currently needed for speech processing. In addition, at least part of the information used to generate the top-level grammar and/or

the related subgrammars (*e.g.*, a selected grammar) may be provided (or selected from a set of local possibilities) by a remote computer or server, to further conserve the memory required to operate the speech recognition system (which may be implemented, for example, in a portable device).

The Applicants' independent claims 1, 11, 18, 34, 35 and 36 clearly recite this step of using a grammar provided by a remote computer in the generation of a set of data structures (*e.g.*, a grammar, a word subgrammar, a phone subgrammar and a state subgrammar) for speech recognition processing. As described above, Sharma does not teach this step. Accordingly, the Applicants respectfully submit that independent claims 1, 11, 18, 34, 35 and 36 fully satisfy the requirements of 35 U.S.C. §102 and are patentable thereunder.

Dependent claims 3-6, 8-10 and 12-17 and 19-33 depend from claims 1, 11 and 18 and recite additional features therefore. As such, and for at least the same reasons set forth above, the Applicants submit that claims 3-6, 8-10, 12-17 and 19-33 are not anticipated by the teachings of Sharma. Therefore, the Applicants submit that dependent claims 3-6, 8-10, 12-17 and 19-33 also fully satisfy the requirements of 35 U.S.C. §102 and are patentable thereunder.

II. REJECTION OF CLAIMS 2 AND 12 UNDER 35 U.S.C. §103

The Examiner rejected claims 2 and 12 under 35 U.S.C. §103(a) as being made obvious by the Sharma in view of the Chou et al. patent (U.S. Patent No. 5,805,772, issued September 8, 1998, hereinafter "Chou"). The Applicants respectfully traverse the rejection.

Particularly, the Applicants respectfully direct the Examiner's attention to the fact that Chou, like Sharma, fails to disclose or suggest the novel invention of generating a grammar and one or more related subgrammars (including, for example, a word subgrammar, a phone subgrammar and a state subgrammar) based at least in part on a grammar provided by a remote computer, as claimed in Applicants' independent claims 1 and 11. Accordingly, the Applicants respectfully submit that independent claims 1 and 11 fully satisfy the requirements of 35 U.S.C. §103 and are patentable thereunder.

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Dependent claims 2 and 12 depend from claims 1 and 11 and recite additional features therefore. As such, and for at least the same reasons set forth above, the Applicants submit that claims 2 and 12 are not made obvious by the teachings of Sharma in view of Chou. Therefore, the Applicants submit that dependent claims 2 and 12 also fully satisfy the requirements of 35 U.S.C. §103 and are patentable thereunder.

III. CONCLUSION

Thus, the Applicants submit that all of the presented claims now fully satisfy the requirements of 35 U.S.C. §102 and 35 U.S.C. §103. Consequently, the Applicants believes that all of these claims are presently in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issue are earnestly solicited.

If, however, the Examiner believes that there are any unresolved issues requiring the issuance of a final action in any of the claims now pending in the application, it is requested that the Examiner telephone Mr. Kin-Wah Tong, Esq. at (732) 530-9404 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

3/29/07
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